

RESEARCH PROJECT STATEMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.
Project No: F-9-1 Title: Anadromous Fish Populations Studies - Southwestern Kenai Peninsula and Kachemak Bay Areas.
Job No: 7-B-2

Period Covered: July 1, 1968 to June 30, 1969.

ABSTRACT

Creel census of the lower Kenai Peninsula king salmon, Oncorhynchus tshawytscha, punch-card fishery, conducted on Deep Creek and Anchor and Ninilchik Rivers, showed an observed catch of 423 fish over 20 inches in fork length. The punch-card reported harvest of 552 king salmon was projected for a total estimated catch of 614 fish of which 40.2 percent were taken from the Anchor River.

Escapement surveys on Stariski Creek, Deep Creek, Ninilchik and Anchor Rivers provided minimum escapement estimates of 124, 195, 450, and 528 king salmon, respectively. Except for the Ninilchik River, these estimates were the smallest recorded since 1962.

The dominant age groups in the king salmon population samples of the Anchor and Ninilchik Rivers were 1.4 and 1.2, respectively. Age groups 1.2 and 1.3 were equally represented in the Deep Creek sample.

Kenai River king and silver salmon, O. kisutch, smolts were separated to species by fork length. All silver salmon smolts were larger than 100 mm, and 72.0 percent of the sample was age II. About 90 percent of the king salmon smolts were less than 100 mm, and 91 percent of the sample was age I. Age-length relationships are described for both species.

Periodic creel census of the lower Kenai Peninsula streams indicated that pink salmon, O. gorbuscha, and Dolly Varden, Salvelinus malma, arrived in early July. Silver salmon, followed by steelhead trout, Salmo gairdneri, occurred in early August. Catch rates are presented for each stream. Anchor River anglers, exerting an estimated 3,045 man-days of effort from July 6 to October 19, harvested an estimated 350 pink salmon, 4,350 Dolly Varden, 1,150 silver salmon, and 102 steelhead.

A total of 239 Anchor River adult silver salmon scales were analyzed of which 85.8 percent were age 2.1. The majority of the Anchor River steelhead sample (62.2 percent) was age 3.2.

RECOMMENDATIONS

1. Retain the present objectives of the study.
2. Delineate silver salmon spawning areas for establishing index sites to determine relative yearly abundance.
3. Initiate a study of king and silver salmon and steelhead smolt emigration timing, age and growth, and distribution.

4. Determine age, growth and emigration timing of king and silver salmon fry and smolts in the lower Kenai River.

OBJECTIVES

1. To investigate, evaluate and develop plans for the enhancement of anadromous fish stocks.
2. To determine the recreational catch of anadromous fishes and evaluate angling pressure in the fresh waters of the southwestern Kenai Peninsula and the marine waters of Kachemak Bay.
3. To investigate and evaluate population trends for anadromous fish species in the major recreational waters of the southwestern Kenai Peninsula and Kachemak Bay.
4. To evaluate the effect of current management techniques, to make recommendations for future management and to direct the course of future studies relating to anadromous fishes within the job area.

TECHNIQUES USED

Creel census of the Kenai Peninsula king salmon, O. tshawytscha, punch-card fishery was described by Engel (1966). A partial creel census to obtain angler harvest, effort and population data on anadromous Dolly Varden, S. malma, silver salmon, O. kisutch, and steelhead trout, Salmo gairdneri, stocks was conducted from July 6 to October 20, 1968.

Minimum king salmon spawning escapements were estimated by foot and aerial surveys as described by Logan (1963) and Engel (1964). King salmon carcasses were measured for fork length and examined for sex during foot surveys. Limited foot surveys were made on Twitter Creek and the South Fork of the Anchor River to locate silver salmon spawning grounds.

Scale samples were collected from adult king and silver salmon and steelhead populations in the lower Kenai Peninsula streams, as well as king and silver salmon smolts in the Kenai River. Cellulose-acetate scale impressions were read by microprojector to determine age structures of these stocks.

FINDINGS

Descriptions of the study area and drainages on the southwestern Kenai Peninsula and prior information collected on this project are presented in Federal Aid in Fish Restoration Progress Reports by Dunn (1960), Logan (1961, 1962 and 1963), Engel (1964, 1965 and 1966), and Redick (1967).

King Salmon Studies

Harvest:

An intensive creel census was conducted on Deep Creek and Anchor and Ninilchik Rivers to determine when the area quota of 500 king salmon over 20 inches (50.8 cm) in fork length was reached. Regulation of the 1968 punch-card fishery was identical to that of 1967. No creel census was attempted in 1968 on the Kenai River because of light angling effort and consequent low catch reported for that river in 1966 and 1967. The poor angling success experienced on the Kenai River during the punch-card fishery may be attributed to the fact that it is a large, glacial river and the main king salmon migration does not occur until June or July.

The fishery, May 25 through June 3, was twice as long (10 days) as that of 1967 due to moderately high and turbid stream flows and the

apparent sparseness of king salmon during the first five days. As water conditions improved, so did angler success. Table 1 shows the observed and reported 1968 king salmon harvest per day for each stream.

TABLE 1 - Observed and Punch-Card Reported (in parentheses) King Salmon Catch Timing and Distribution, Kenai Peninsula, 1968.

Date	Anchor River	Ninilchik River	Deep Creek	Kenai River	Cumulative Totals
5/25	24 (25)	34 (43)	3 (5)		61 (73)
5/26	18 (18)	4 (13)	3 (6)	(1)	86 (111)
5/27	13 (14)	3 (11)	5 (6)		107 (142)
5/28	5 (12)	6 (11)	1 (1)		119 (166)
5/29	16 (16)	7 (16)	4 (7)	(2)	146 (207)
5/30	20 (30)	20 (26)	6 (9)		192 (272)
5/31	34 (34)	15 (26)	29 (29)		270 (361)
6/1	24 (30)	14 (18)	14 (20)		322 (429)
6/2	21 (26)	15 (16)	30 (36)	(1)	388 (508)
6/3	16 (17)	1 (5)	18 (22)		423 (552)
TOTAL	191 (222)	119 (185)	113 (141)	(4)	423 (552)
Percent Catch by Stream	(40.2)	(33.5)	(25.5)	(0.8)	(100.0)

A total of 9,524 king salmon punch cards were issued to Cook Inlet sport fishermen in 1968. Of these, 6,724 (70.6 percent) were voluntarily returned, leaving 2,800 punch cards outstanding. The anglers returning cards reported a harvest of 552 Kenai Peninsula king salmon.

Catches declined after May 25 in the Anchor and Ninilchik Rivers. On May 29, either due to an improvement of stream conditions or a greater influx of king salmon, or both, daily catches increased substantially. Deep Creek, which remained high and turbid for the longest period time, showed reduced harvests until May 31 when its high discharge subsided. As in 1966 and 1967, the sharp decline of the second day's catch in the Ninilchik River follows Engel's (1966) suggestion that the first day's harvest consists of vulnerable "holding fish"--the survivors of which probably remain in hiding or migrate upstream by the second day.

Two different methods were used to estimate the number of fish caught by non-reporting anglers. One method was based on reminder letter sampling, the other on Redick's (1967) ratio. By the former method, punch-card reminder letters were mailed to 468 (16.7 percent) randomly-selected non-reporting anglers. Of these individuals, 266 (56.8 percent) replied and reported catching six Kenai Peninsula king salmon. By extrapolation, the 2,800 punch-card non-reporting anglers would have caught 63 fish. This number is a minimum since it does not include fish caught by anglers who did not respond to reminder letters. Adding the estimated 63 unreported fish to the 552 reported yields an estimated minimum harvest of 615 Kenai Peninsula king salmon. It is known that non-reporting anglers caught at least 43 king salmon since that many were checked but unreported; therefore, the actual minimum harvest was 595 fish.

Redick's (1967) ratio method was applied as follows:

$$\begin{array}{lcl} \text{Fish creel checked} & \frac{\text{Punch card returned}}{\text{Punch card not returned}} = & \text{Fish not Creel checked} \frac{\text{Punch card returned}}{\text{Punch card not returned}} \\ & \frac{380}{43} = \frac{168}{X} & X = 19 \end{array}$$

This ratio estimated a total catch composed of:

Total fish creel checked	423
Punch cards returned, fish not checked	168
Punch cards returned from Kenai River	4
<u>Punch cards not returned, fish not checked</u>	<u>19</u>

Total estimated catch	614
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This ratio assumes that the rate of punch cards returned is the same for anglers whose fish were creel checked as those whose fish were not creel checked (Redick, 1967). The catch of four Kenai River king salmon was omitted from the above calculation since no creel census was conducted on that river.

The projected totals of 614 and 615 king salmon by both methods are in remarkable agreement and believed to be an accurate estimate of the true sport harvest. The total estimated catch per location is as follows:

Anchor River	247
Ninilchik River	206
Deep Creek	157
Kenai River	4

These totals were calculated by adding each river's unreported, creel-checked fish to their reported harvests. In addition, a relative proportion of the estimated 19 fish, according to each river's percent contribution (Table 1) to the total reported harvest, was added to the foregoing.

The success rate of reporting anglers who fished was computed to be considerably higher than that of non-reporting anglers who fished. Of the 6,724 reporting anglers, 3,529 (52.0 percent) indicated that they had fished Cook Inlet streams for king salmon; their success rate was 15.6 percent. Of the 266 individuals who responded to reminder letter sampling, 117 (44.0 percent) reported fishing Cook Inlet streams; their success rate was 5.1 percent. Both of these rates are considered minimal for the lower Cook Inlet fishery since they are based on anglers who fished both upper and lower Cook Inlet streams. The 5.1 percent minimum success rate for non-reporting anglers is identical to that determined by Redick in 1967.

According to punch-card returns, there were 479 successful king salmon anglers on the Kenai Peninsula, with 330 (69.0 percent) being creel censused. Of the total estimated 614 king salmon caught, 423 (68.8 percent) were creel checked. Limit catches (two fish per angler) comprised 38.4 percent of the reported harvest and were taken by 22.1 percent of the successful anglers. This rate is comparable to 21.2 and 22.0 percent for the 1966 and 1967 punch-card fisheries, respectively. Precocious males ("jacks") under 20 inches comprised 14.3 percent of the total known catch.

Origin of successful anglers, according to punch-card returns, was as follows: 24.7 percent Kenai Peninsula-addressed; 68.5 percent other Alaskan-addressed (mostly Anchorage); and 6.8 percent non-residents and juveniles.

Escapement:

Aerial and foot surveys were conducted prior to, during and after the peak of spawning to estimate relative abundance of king salmon spawning populations in the Anchor River, Stariski Creek, Deep Creek, and Ninilchik River. Based on foot-survey counts, peak of spawning occurred during the first week of August, when the percentage of carcassed to live fish reached 30 percent on the Anchor and Ninilchik Rivers spawning beds. Ideal weather and low, clear stream flows provided optimum conditions for escapement surveys.

The Anchor River spawning population, estimated to be 528 king salmon, is only 41 percent of the 1960-1967 average of 1,273 fish and is the smallest recorded. Table 2 summarizes Anchor River spawning escapements, sex ratios and estimated number of spawning females for 1960 through 1968. Combining the estimated sport harvest of 247 fish with the minimum escapement of 528, the total run is estimated to have been a minimum of 775 king salmon.

TABLE 2 - Summary of Escapement, Sex Ratios and Estimated Number of Spawning Female King Salmon, Anchor River, 1960-1968.

<u>Year</u>	<u>Estimated Total Escapement</u>	<u>Male:Female Sex Ratio</u>	<u>Estimated Spawning Females</u>	<u>Method of Determination</u>
1960	1,200	0.9:1	631	Aerial & foot survey
1961	850	1.2:1	386	Aerial & foot survey
1962	970	0.8:1	539	Aerial & foot survey
1963	1,340	1.0:1	670	Aerial & foot survey
1964	1,700	1.4:1	708	Aerial & foot survey
1965	1,600	1.7:1	593	Aerial & foot survey
1966	1,325	0.8:1	736	Foot surveys
1967	1,195	0.7:1	700	Aerial & foot survey
1968	528	1.7:1	195	Aerial & foot survey
1960-1967 Average	1,273	1.1:1	620	

The Anchor River male-to-female carcass sex ratio of 1.8:1 is the highest recorded for males in eight years. However, the sport-catch sex ratio was almost equal (1.1:1). This was due to a greater angler selection toward larger 5- and 6-year-old fish which would exclude 3- and 4-year-old males. By adding the punch-card reported 45 "jacks" (less than 20 inches) to the sport catch, the resulting sex ratio is 1.7:1. Therefore, a sex ratio of 1.7:1 was determined to closely approximate the sex composition of the 1968 population. Table 2 shows that an estimated 195 females, or less than half of the previous smallest number in 1961, spawned in 1968.

Table 3 summarizes estimated king salmon spawning populations in Deep Creek, Ninilchik River and Stariski Creek from 1962 to 1968. Only the Ninilchik River escapement showed an increase (25 percent) over the 1967 level, although this was still about 32 percent below the six-year average. Stariski and Deep Creeks' estimated spawning escapements were approximately 64 and 68 percent, respectively, below the 1962 to 1967 average.

TABLE 3 - Estimated King Salmon Escapements for Deep Creek Stariski Creek and the Ninilchik River, 1962-1968.

<u>Stream</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1962-1967 Average</u>
Deep Creek	745	605	800	690	540	265	195	608
Ninilchik River	525	450	910	1,025	670	360	450	657
Stariski Creek	355	265	582	330	---	195	124	345

According to Commercial Fisheries Division catch statistics for 1968, the incidental commercial catch of 4,670 king salmon was about half of

previous years levels. Most of these fish were taken in the vicinity of the Kenai and Kasilof Rivers during July, further substantiating the foregoing low escapement estimates.

The male-to-female carcass sex ratio in the Ninilchik River was 1.7:1, which closely resembled the sport-catch ratio of 1.6:1. By extrapolation, the total estimated minimum escapement of 450 king salmon consisted of 315 males and 135 females.

The Deep Creek male-to-female sport-catch sex ratio was 1.7:1. An insufficient number of carcasses was found to be able to determine a carcass sex ratio. The total minimum spawning escapement in 1968 was estimated at 195 king salmon, consisting of 123 males and 72 females.

An insufficient number of carcasses was observed in Stariski Creek to determine the escapement's sex ratio. This stream was closed to king salmon fishing.

Relative effectiveness of king salmon aerial versus foot surveys on the Kenai Peninsula streams is given in Table 4. Except for Stariski Creek, the percent of the spawning run within the index area, as estimated by aerial survey, was higher than in previous survey years. Very low stream-flow levels may have caused the spawning fish to utilize lower portions of the streams than in normal water-flow years. No king salmon were observed in headwaters or upper tributaries of these drainages in 1968.

TABLE 4 - Relative Effectiveness of King Salmon Aerial and Foot Surveys on Kenai Peninsula Streams.

Name of Stream	Year	Estimated Percent of Run Within Index Area by Aerial Survey	Percent Success of Aerial vs. Foot Surveys Within Index Areas
Anchor River	1962	31/212 = 14.6	31/196 = 15.8
	1963	112/454 = 24.7	112/239 = 46.9
	1964	89/299 = 29.8	89/379 = 23.5
	1965	39/347 = 11.2	39/180 = 21.7
	1966	No aerial survey	/300 = --
	1967	64/210 = 30.5	64/363 = 17.6
	1968	42/114 = 36.8	42/176 = 23.9
Deep Creek	1962	28/89 = 31.5	28/191 = 14.7
	1963	138/400 = 34.5	138/258 = 53.5
	1964	57/275 = 20.7	57/165 = 34.5
	1965	31/167 = 18.6	31/128 = 24.2
	1966	No aerial survey	/107 = --
	1967	20/139 = 14.4	20/38 = 52.6
	1968	25/67 = 37.3	25/73 = 34.2
Ninilchik River	1962	15/47 = 31.9	15/143 = 10.5
	1963	73/179 = 40.8	73/193 = 37.8
	1964	76/200 = 38.0	76/347 = 21.9
	1965	70/224 = 31.3	70/319 = 21.9
	1966	No aerial survey	/231 = --
	1967	59/100 = 59.0	59/213 = 27.7
	1968	19/31 = 61.3	19/126 = 15.1
Stariski Creek	1962	3/18 = 16.7	3/44 = 6.8
	1963	11/53 = 20.8	11/74 = 14.9
	1964	61/152 = 40.1	61/234 = 26.1
	1965	23/94 = 24.5	23/80 = 28.8
	1966	No aerial survey	No count
	1967	13/31 = 41.9	13/82 = 15.9
	1968	7/29 = 24.1	7/30 = 23.3

Population Structure - Anchor River

King salmon population data was collected from both sport-caught fish and carcasses. Figure 1 shows that carcass length frequencies do not adequately represent those of the sport catch. Carcass length frequencies do, however, closely resemble those of the sport catch (sexes combined) in the 75 to 95 cm range. According to combined age-length frequency data collected since 1960, this length range includes all age 1.3 and about half of age 1.4 king salmon. Relative abundance of the age 1.2 males and larger 1.4 fish is not accurately shown by the carcass sample. The carcass data thus tends to bias the 1968 population structure toward the intermediate length range, assuming that the sport harvest is a representative sample of the true population.

Redick (1967) noted that the timing of carcass sampling is important because of the apparent differential die-off period of the two sexes. In 1968, carcass recoveries revealed that males predominated the counts until very late in the spawning period. Peak of spawning was estimated to have occurred on about August 3 and 4, when carcasses were about 30 percent as numerous as live fish. On August 8, 24 males and 9 females were counted on the lower index area. On August 13, the upper index count indicated that females were dying at about the same rate as males, with 10 male and 11 female carcasses recorded. The same die-off pattern was observed to occur in the Ninilchik River. Thus, it appears that carcass recovery timing is important to eliminate bias in the carcass sex ratio and length-frequency data, especially during a strong male year such as 1968.

Scales collected from 168 sport-caught king salmon over 20 inches in length were read to determine the population's age composition. Age group frequencies and mean lengths by sex are presented in Table 5. As in 1967, age group 1.4 dominated the harvest, comprising 46.4 percent of the sample. Table 6 summarizes king salmon length-frequency data collected from 1964 to 1968.

Population Structure - Ninilchik River

Population data from carcasses and sport-caught king salmon were collected from the Ninilchik River for the fifth successive year. Length-frequency data of carcasses and sport-caught king salmon in 1968 are compared in Figure 2. Carcass length frequencies more closely represented the sport catch in this stream than in the Anchor River. A summary of length frequencies, sample sizes and mean lengths from 1964 to 1968 is presented in Table 7. The high percentage of 1.2 males in 1968 results in the smallest average length for all males and the total sample since 1964.

Scales from 100 sport-caught king salmon were analyzed to determine the run's age composition. Table 8 presents age group frequencies from 1966 to 1968. Age group 1.2 was found to be the dominant year class in 1968, comprising 42.0 percent of the sample. Age groups 1.4 (30.0 percent) and 1.3 (21.0 percent) were the next most abundant age classes.

TABLE 8 - Age Group Frequency of King Salmon by Percent, Ninilchik River, 1966 to 1968.

Year	Sample Size	Age Group							
		1.1	1.2	2.2	1.3	2.3	1.4	2.4	1.5
1966	82	---%	22.0%	---%	45.2%	2.2%	30.4%	---%	---%
1967	78	2.6	6.4	1.3	30.8	1.3	56.4	---	1.3
1968	100	4.0	42.0	1.0	21.0	1.0	30.0	1.0	---

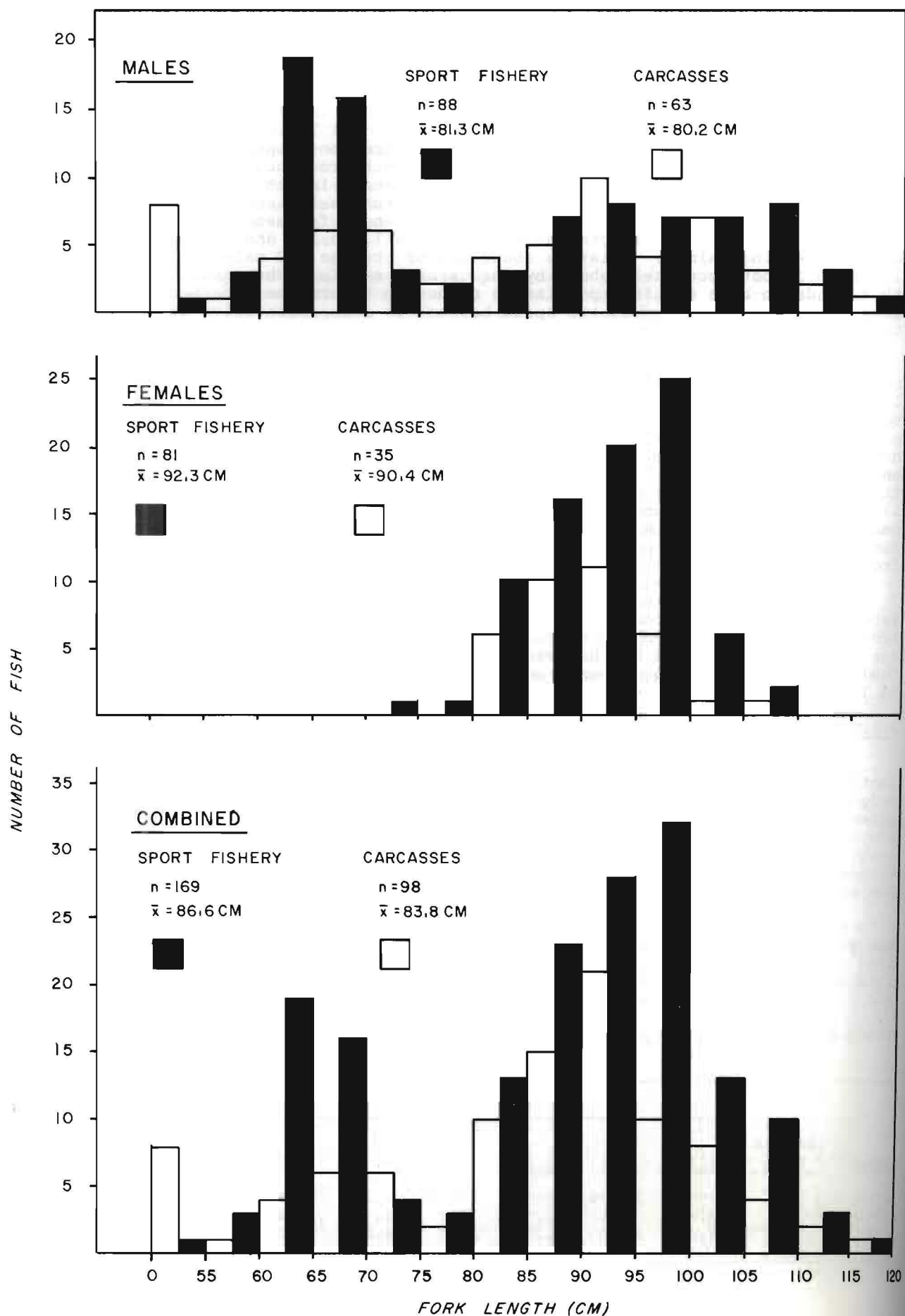


FIGURE 1. LENGTH-FREQUENCY OF KING SALMON CARCASSES AND SPORT-CAUGHT KING SALMON, ANCHOR RIVER, 1968.

TABLE 5 - Age Class Frequency and Mean Sizes by Sex of Anchor River King Salmon Samples, 1960 to 1968.

Year	Sample Size for Age Determination	Age Group by Percent					Mean Length* and (Number in Sample)		
		1.1	1.2	1.3	1.4	All Other	Male	Female	Combined
1960	199	2.7	6.5	76.0	11.0	3.8	82.3 (88)	82.3 (95)	84.1 (183)
1961	112	2.9	10.6	21.1	64.4	1.0	87.0 (58)	93.8 (49)	90.1 (107)
1962	47	---	31.9	40.4	27.7	---	79.5 (31)	85.9 (40)	83.1 (71)
1963	99	10.1	19.2	49.5	20.2	1.0	71.9 (77)	90.6 (75)	81.1 (152)
1964	---	Carcasses only - No sport fishery					86.1 (60)	91.5 (44)	88.4 (104)
1965	---	Carcasses only - No sport fishery					83.5 (106)	90.7 (62)	86.1 (168)
1966	151	2.6	19.2	42.4	30.5	5.3	77.6 (79)	89.5 (95)	84.1 (174)
1967	112	1.8	8.9	22.3	66.1	0.9	91.8 (97)	94.1 (135)	93.2 (232)
1968	168	0.6**	20.8	31.0	46.4	1.2	80.8 (151)	91.7 (116)	85.5 (267)

*Mean length in centimeters.

**The percent composition of this age group is small because angler and gear selectivity for king salmon larger than 20 inches generally excludes age 1.1 "jacks".

TABLE 6 - A Summary of King Salmon Length Frequency Data, Anchor River, 1964 to 1968.

Sex	Year	Number of Fish															Total Fish	Average Length
		0-50*	55	60	65	70	75	80	85	90	95	100	105	110	115	120		
Male:	1964	5	--	1	1	4	5	3	4	4	9	6	7	8	3	---	60	86.1
	1965	2	2	8	8	17	4	3	2	8	12	18	17	3	2	---	106	83.5
	1966	--	4	16	9	2	1	3	8	15	12	5	2	1	1	---	79	77.6
	1967	6	--	3	5	3	2	5	8	7	6	3	6	22	19	2	97	91.8
	1968	9	--	4	23	22	9	4	7	12	18	11	14	11	5	2	151	80.8
Female:	1964	--	--	--	--	--	--	--	3	16	13	7	5	---	---	---	44	91.5
	1965	--	--	--	--	--	--	3	9	21	14	9	5	---	1	---	62	90.7
	1966	--	--	--	1	--	1	2	18	30	20	15	8	---	---	---	95	89.5
	1967	--	--	--	--	3	--	2	6	26	29	37	28	4	---	---	135	94.1
	1968	--	--	--	--	--	1	1	16	26	31	31	7	3	---	---	116	91.7
Combined:	1964	5	--	1	1	4	5	3	7	20	22	13	12	8	3	---	104	88.4
	1965	2	2	8	8	17	4	6	11	29	26	27	22	3	3	---	168	86.1
	1966	--	4	16	10	2	2	5	26	45	32	20	10	1	1	---	174	84.1
	1967	6	--	3	5	6	2	7	14	33	35	40	34	26	19	2	232	93.2
	1968	9	--	4	23	22	10	5	23	38	49	42	21	14	5	2	267	85.5

*All figures heading columns indicate length in centimeters.

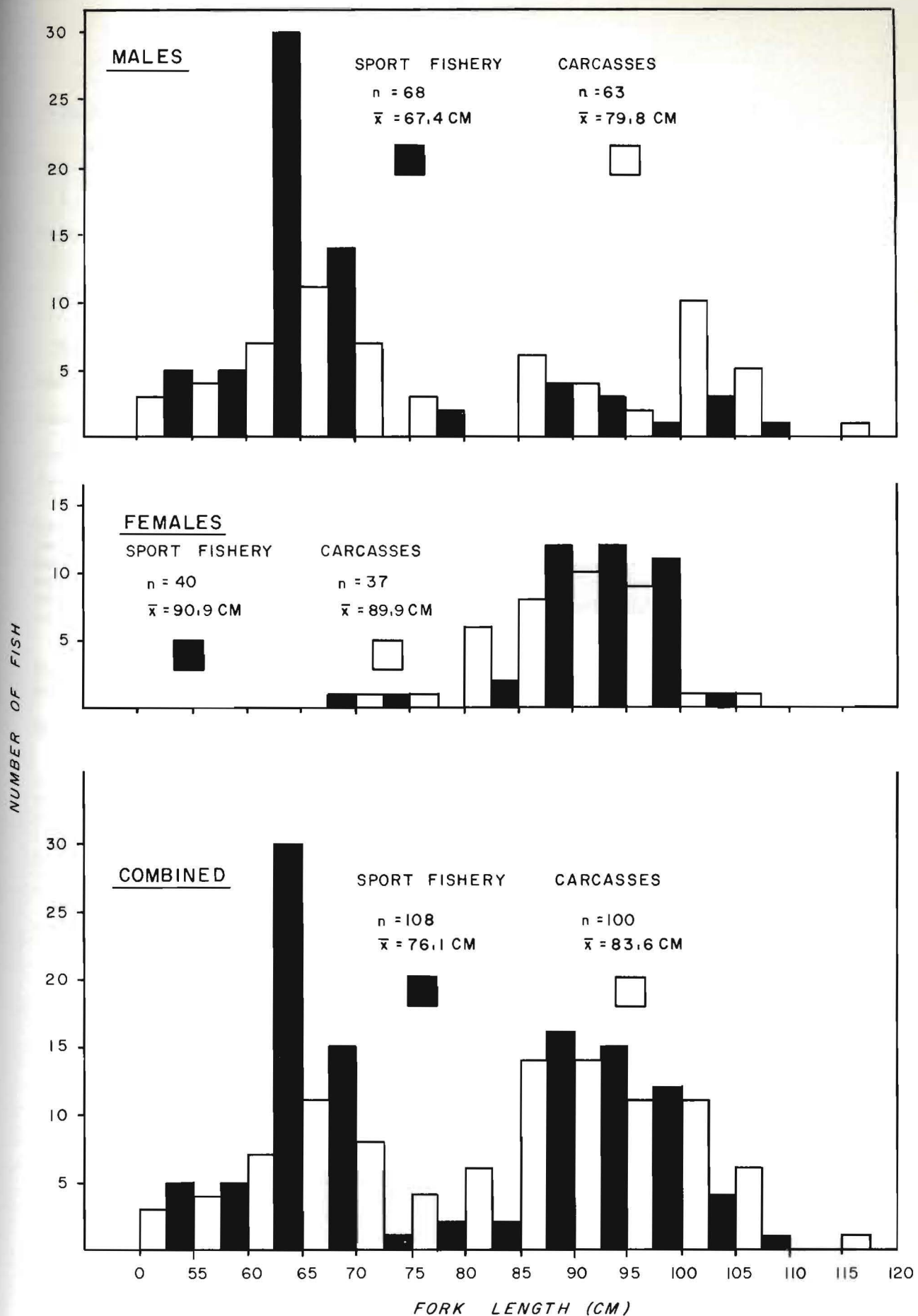


FIGURE 2. LENGTH-FREQUENCY OF KING SALMON CARCASSES AND SPORT-CAUGHT KING SALMON, NINILCHIK RIVER, 1968.

TABLE 7 - Summary of Length Frequencies, Sample Sizes and Mean Length, King Salmon, Ninilchik River, 1964 to 1968.

Sex	Year	Number of Fish															Total Fish	Average Length
		0-50*	55	60	65	70	75	80	85	90	95	100	105	110	115	120		
Male:	1964	6	--	1	6	5	7	--	4	7	5	4	4	7	1	---	57	80.5
	1965	5	1	--	4	2	--	--	3	7	5	7	6	3	1	2	46	84.9
	1966	--	1	9	12	3	--	3	7	8	8	4	1	1	2	---	59	77.8
	1967	2	2	3	--	1	1	1	4	3	4	2	5	4	1	---	33	80.4
	1968	5	--	5	30	14	--	2	--	4	3	1	3	1	---	---	68	67.4
Female:	1964	--	--	--	--	--	--	1	16	12	11	3	---	---	---	---	43	86.9
	1965	--	--	--	--	--	--	2	9	15	12	7	2	---	---	---	47	89.3
	1966	--	--	--	--	--	1	3	12	12	14	7	2	---	---	---	51	88.3
	1967	--	--	--	--	--	--	4	6	8	11	13	6	1	---	---	49	91.4
	1968	--	--	--	--	1	1	--	2	12	12	11	1	---	---	---	40	90.9
Combined:	1964	6	--	1	6	5	7	1	20	19	16	7	4	7	1	---	100	83.3
	1965	5	1	--	4	2	--	2	12	22	17	14	8	3	1	2	93	87.1
	1966	--	1	9	12	3	1	6	19	20	22	11	3	1	2	---	110	82.7
	1967	2	2	3	--	1	1	5	10	11	15	15	11	5	1	---	82	87.3
	1968	5	--	5	30	15	1	2	2	16	15	12	4	1	---	---	108	76.1

*All figures heading columns indicate length in centimeters.

Population Structure - Deep Creek

Scales from 105 sport-caught fish were analyzed to determine the sport-catch's age structure. Table 9 presents age group frequencies. Age groups 1.2 and 1.3 each comprised 32.4 percent of the sport catch, and age group 1.4 contributed 26.7 percent to the harvest.

TABLE 9 - Age Group Frequency of King Salmon by Percent, Deep Creek, 1968.

<u>Sex</u>	<u>Age Group</u>									<u>Sample Size</u>
	<u>1.1</u>	<u>2.1</u>	<u>0.2</u>	<u>1.2</u>	<u>2.2</u>	<u>1.3</u>	<u>2.3</u>	<u>1.4</u>	<u>2.4</u>	
Male	4.5	---	---	51.5	6.1	24.2	---	13.6	---	66
Female	---	---	---	---	---	46.1	2.6	48.7	2.6	39
Combined	2.9	---	---	32.4	3.8	32.4	0.9	26.7	0.9	105

According to the population sample, 36.2 percent of the 1968 sport catch was comprised of two ocean males (1.2 and 2.2 age groups) with 57.6 percent of all males being from these age groups. In 1967, two ocean males made up 26.2 percent of the catch, and over 40.0 percent of all males were represented by age groups 1.2 and 2.2 (Redick, 1967). The male-to-female sex ratio of 1.7:1 further emphasizes the strength of the two ocean males in the 1968 spawning run.

Length frequency distribution by sex of the sport catch is shown in Figure 3. Insufficient carcasses were recovered during escapement foot surveys to compare with the sport harvest.

Kenai River Smolt Studies

In 1967, the Commercial Fisheries Division of the Alaska Department of Fish and Game sampled the Kenai River red salmon, *O. nerka*, smolt migration with four inclined plane traps operated under the Sterling Highway bridge at Soldotna. Sport Fish biologists were able to obtain samples of incidentally-caught king and silver salmon smolts from these traps. A total of 504 smolts, known to be either king or silver salmon, were collected from May 23 to June 17. Engel (1967) found that 98.7 percent of the king salmon smolts were less than 100 mm in fork length, and 92.8 percent of the silver salmon smolts were larger than 100 mm. Therefore, in 1968, each weekly sample was separated as to species by size. Each smolt was subsequently checked for proper species identification by noting pigmentation of its adipose fin. King salmon smolts show an unpigmented area on the anterior base of their adipose, whereas on silver salmon smolts, the adipose is completely pigmented. This characteristic was verified by Engel in 1967 for Kenai River fish by means of pyloric caeca counts of 50 randomly-selected smolts.

Age-length relationships of the king and silver salmon smolt samples are shown in Figure 4. Approximately 72.0 percent of the silver salmon were age II with a length range of 104 to 155 mm and a mean length of 121.8 mm. Compared to the 1967 silver salmon smolt sample, age II smolts in 1968 showed a 17.9 percent decrease in abundance and a 3.2 mm reduction in mean length for the same sampling period. Age III smolts comprised 26.8 percent of the sample and ranged from 121 to 171 mm with a mean length of 145.0 mm. In 1967, age III smolts constituted only 5.8 percent of the total, but ranged from 136 to 173 mm with a mean length of 151.9 mm. Age I smolts (n=2), in 1968, had a mean length of 100.5 mm. All 168 silver salmon collected were larger than 100 mm in fork length. During the first

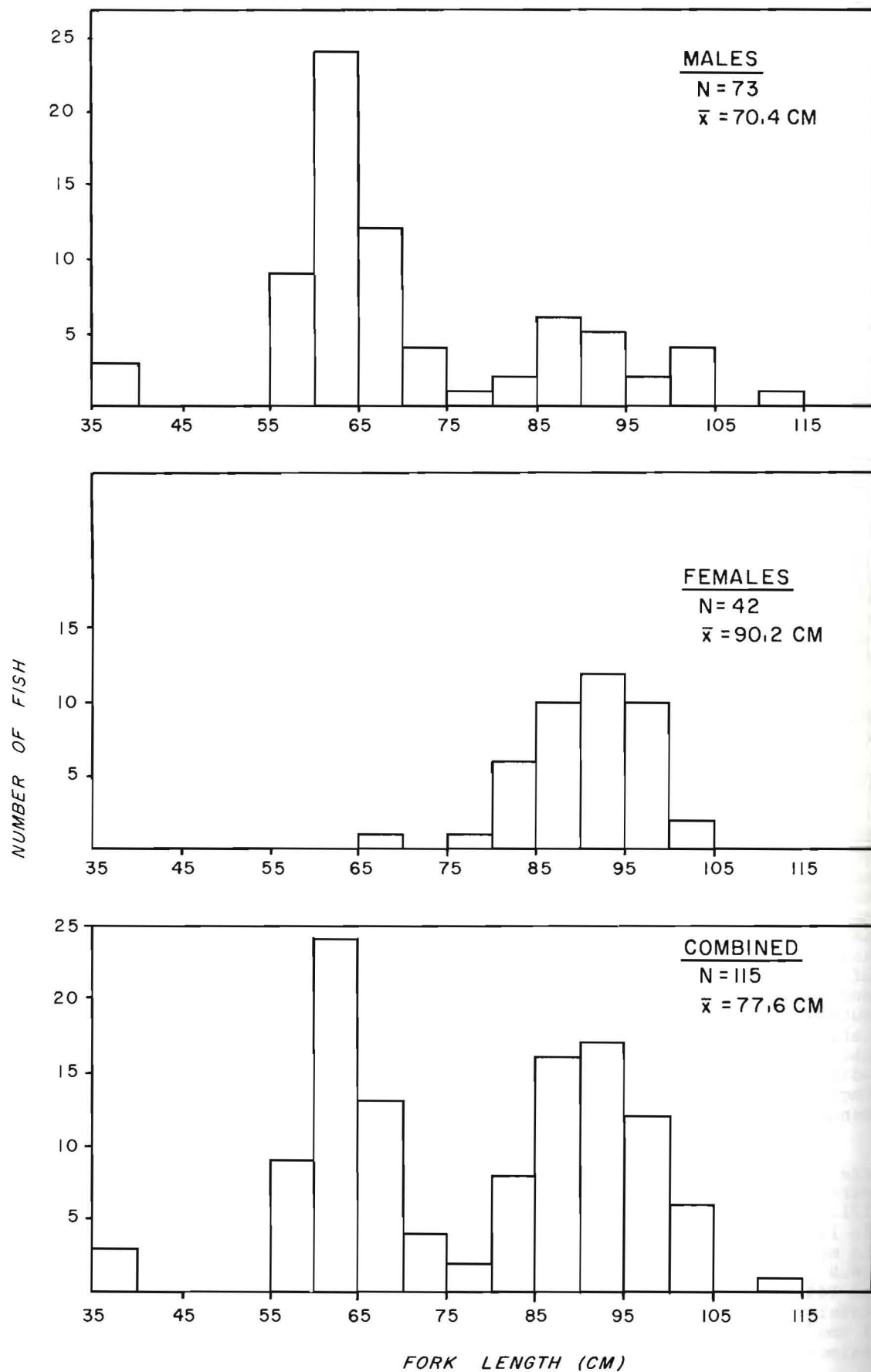


FIGURE 3. LENGTH FREQUENCY OF SPORT-CAUGHT KING SALMON, DEEP CREEK, 1968.

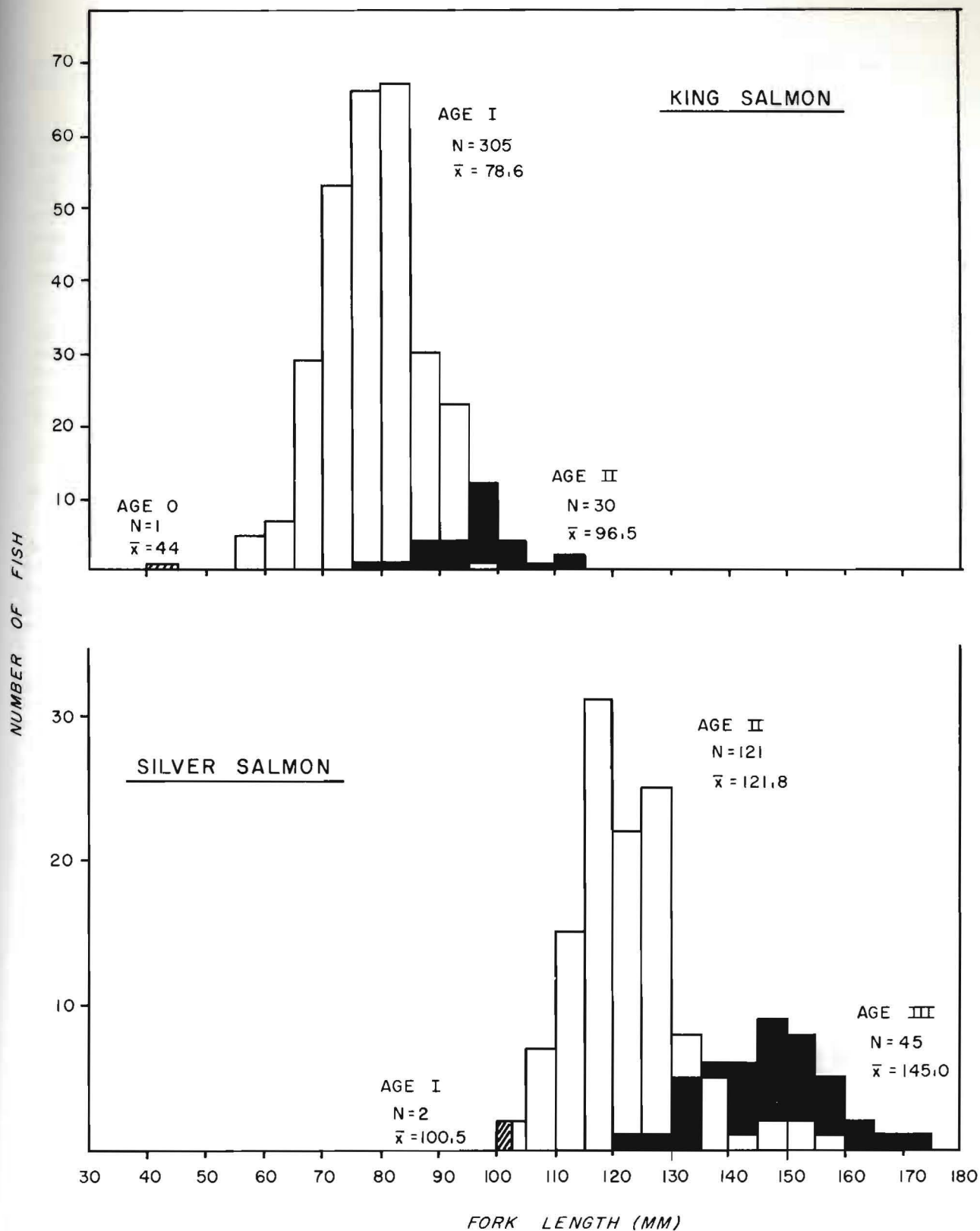


FIGURE 4. THE RELATIONSHIP OF LENGTH TO AGE OF KENAI RIVER KING AND SILVER SALMON SMOLTS, 1968.

TABLE 10 - Estimated Sport Fish Harvests, Anchor River, 1968.

Census Period	Anglers Checked	Catch Per Hour**		Fish Per Angler		Estimated Total Sport Fish Harvests	
		Weekdays	Weekends	Weekdays	Weekends	Weekdays	Weekends
July 6 - 31*	54	0.96 DV		3.00 DV		1,848 DV	
		0.11 PS		0.33 PS		203 PS	
August 1 - 12*	34	0.13 SS		0.41 SS		175 SS	
		0.01 SH		0.03 SH		13 SH	
		0.82 DV		2.56 DV		1,096 DV	
		0.06 PS		0.18 PS		77 PS	
August 13 - September 15	688	0.35 SS	0.26 SS	0.76 SS	0.49 SS	612 SS	297 SS
		0.01 SH	0.01 SH	0.03 SH	0.02 SH	24 SH	12 SH
		0.09 DV	0.09 DV	0.19 DV	0.17 DV	153 DV	103 DV
		0.03 PS	0.01 PS	0.07 PS	0.02 PS	56 PS	12 PS
September 16 - October 19*	237	0.05 SS		0.11 SS		65 SS	
		0.04 SH		0.09 SH		53 SH	
		0.80 DV		1.95 DV		1,152 DV	

*Due to insufficient weekday and/or weekend censuses during these periods, catch data was combined.

**SS = Silver salmon SH = Steelhead trout DV = Dolly Varden PS = Pink Salmon

week of sampling (May 23 to 29), age III smolts were nearly as abundant as age II smolts in the seaward migration.

The king salmon smolt sample was composed of 0.3 percent young-of-the-year (age 0), 90.8 percent age I and 8.9 percent age II smolts. Age I migrants ranged from 57 to 99 mm with a mean length of 78.6 mm. In 1967, age I smolts (96.0 percent) had a similar length range (51 to 98 mm), but the mean length was 73.9 mm. Age II smolts in 1968 ranged from 78 to 111 mm with a mean length of 96.5 mm. In 1967, age II smolts (2.3 percent) ranged from 95 to 113 mm with a mean length of 103.0 mm. Of the 336 king salmon smolts sampled in 1968, 97.9 percent were smaller than 100 mm in fork length.

Small sampling errors, involved in collecting smolt samples, were mistaking red salmon for king and silver salmon and inaccurate measurement of smolts. The small percentage (2.1) of king salmon smolts over 100 mm and the absence of any silver salmon smolts less than 100 mm in 1968, demonstrates the high degree of accuracy obtainable in separating these species by size in the Kenai River system.

Silver Salmon Studies

Anchor River:

A periodic creel census was conducted from July 6 to October 19 to determine angler success, and thus estimate relative timing and magnitude of anadromous fish runs. Only sporadic creel census was possible before August 13 and after September 15. Therefore, weekend and weekday catch data was combined and extrapolated for the total effort and harvest for each of those census periods.

The first observed silver salmon was taken on July 24 with catches gradually increasing in abundance by August 13, the first day of intensive creel census. Tables 10 and 11 summarize the catch data and present estimates of total sport fishing effort and harvest. About 70 percent of the weekdays from August 13 to September 15 were censused. A projected total of 805 anglers was estimated to have taken 612 silver salmon in the 23 weekdays occurring during the period. On weekend days (Labor Day included), of which 82 percent were sampled, a projected 605 anglers caught an estimated total of 297 silver salmon. That weekday anglers tended to "out fish" the more casual weekend fishermen is fairly evident in the relative catch rates for this period (Table 10).

TABLE 11 - Estimated Sport Fishing Effort, Anchor River, 1968.

Census Period	Mean Number of Anglers Per Day*		Number of Fishing Days		Estimated Man- Days of Effort	
	Weekdays	Weekends	Weekdays	Weekends	Weekdays	Weekends
July 6 - 31	20	32	18	8	360	256
August 1 - 12	30	47	8	4	240	188
August 13 - September 15	35	55	23	11**	805	605
September 16 - October 19	15	24	25	9	375	216
Total					1,780	1,265
Grand Total					3,045	

TABLE 11 (Cont.) - Estimated Sport Fishing Effort, Anchor River, 1968.

*Except for the period of August 13 to September 15, mean number of anglers per day was computed on the same ratio of weekdays to weekend days as that of August 13 to September 15.

**Includes Labor Day, September 2.

Good silver salmon catches were reported from the first week of August to mid-September, at which time the sport harvest began a rapid decline. Peak catches were observed from August 21 to August 26. Observed catches were dominated by males prior to August 17 and by females through the peak of the migration. That most of the daily catch occurred from daylight until about 9 a.m. was again noted in 1968. Accordingly, creel censuses were conducted most frequently during the early morning period to sample the bulk of the day's catch, with mid-day, afternoon and evening periods being less intensively covered.

After September 15, a substantial decrease in angling effort was evident due to increasingly adverse fishing conditions prior to freeze-up. Most of the angling effort during this period was directed toward steelhead and Dolly Varden. In spite of freezing air and water temperatures, 237 anglers were interviewed on nine weekend days and three weekdays. An estimated 591 fishermen caught 65 silver salmon during this period. The total projected harvest was 1,150 silver salmon. An estimated 3,045 man-days of effort were expended from July 6 to October 19 (Table 11).

Population data was collected from 242 sport-caught silver salmon. The sample contained 112 males, 115 females and 15 unsexed fish for a male-to-female sex ratio of 1.0:1. Average lengths for males and females were 66.5 and 65.6 cm, respectively, with an average length of 66.0 cm for both sexes. The sample length range was 41.5 to 76.0 cm. Figure 5 shows the length-frequency distribution by 2.54 cm (1 inch) increments.

Scales from 239 silver salmon were analyzed for age determination, and 205 (85.8 percent) were age 2.1. Most of the remaining fish in the sample belonged to age groups 3.1 (6.7 percent) and 1.1 (5.9 percent). Three "jacks" were of age groups 3.0 (0.8 percent) and 2.0 (0.4 percent). Although the incidence of silver salmon with two ocean annuli is uncommon, one fish (male, 68.6 cm) was recorded as determined by four readers.

Foot surveys were conducted October 17 and 18 on the South Fork of the Anchor River (Olson Mountain to Twitter Creek confluence) and lower Twitter Creek to locate silver salmon spawning grounds. Only two silver salmon were observed in the Anchor River and four in lower Twitter Creek. Although freezing temperatures formed surface ice on pools and slow runs, few spawning silver salmon could be missed in these stream sections. It is believed that the main spawning grounds lie farther upstream in the headwaters or upper tributaries.

Deep Creek:

Limited angler creel checks were made from August 15 to September 13 in Deep Creek. Table 12 presents creel census results for this stream. In Deep Creek, where "snagging" prevailed as the most common fishing technique, the weekend catch rate exceeded that of weekdays and was the highest recorded for the lower Kenai Peninsula streams. Although more silver salmon were taken in early morning as on the Anchor River, fish continued to be caught at a high rate throughout the day by snagging. Low, clear water and good weather enhanced the efficiency of this angling technique.

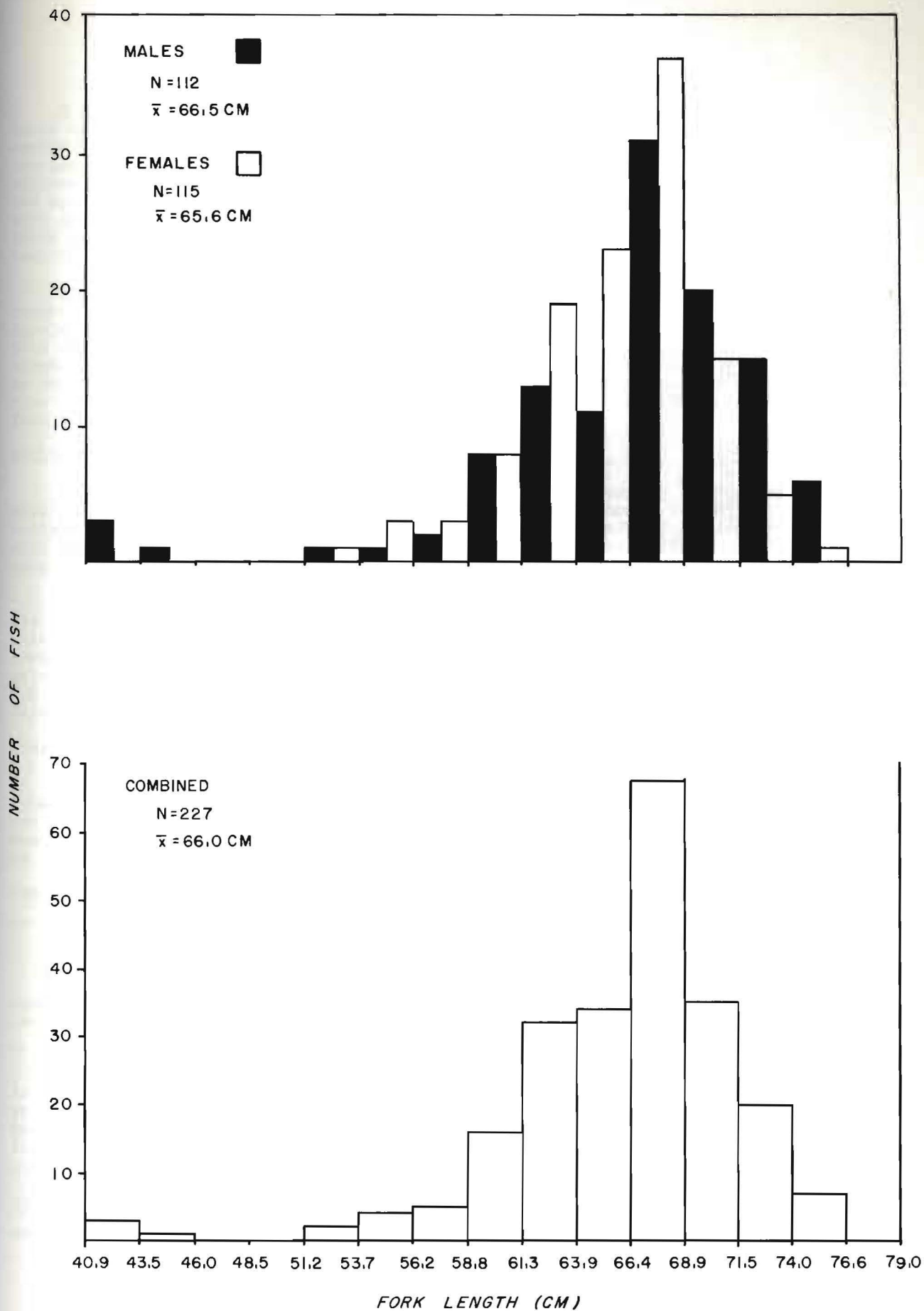


FIGURE 5. LENGTH FREQUENCY OF SPORT-CAUGHT SILVER SALMON,
 ANCHOR RIVER, 1968,

TABLE 12 - Creel Census Results, Deep Creek, 1968.

Census Period	Anglers Checked	Hours Fished	Total Catch	Fish Per Angler		Catch Per Hour	
				Weekdays	Weekends	Weekdays	Weekends
July 7 - August 4	41	93.5	6 SS	0.15	SS*	0.06	SS*
			10 RS**	0.24	RS	0.11	RS
			22 DV	0.54	DV	0.24	DV
			2 PS	0.05	PS	0.02	PS
August 15 - September 21	244	503.0	132 SS	0.43	SS	0.21	SS
			3 SH	0.01	SH	--	SH
			3 DV	0.01	DV	--	DV
			38 PS	0.31	PS	0.06	PS
October 12	3	18.0	4 SH		1.33		0.22

*Weekdays and weekends combined.

**RS = Red salmon

A sport fishery for silver salmon existed on incoming tides along the beach between the Deep Creek and Ninilchik River mouths. Although no creel census data was obtained during this fishery, catch rates at the run's peak (August 15 to August 30) are believed to have exceeded those realized by anglers fishing in either stream. Silver salmon readily hit large spoons and spinners while schooling within casting range near shore. These fish were generally larger than the average size of Deep Creek or Ninilchik River silver salmon, which suggests that they may have been bound for the Kasilof and Kenai River systems.

Population data was collected from 103 silver salmon. The sample was comprised of 59 males and 43 females (one fish unsexed) for a male-to-female sex ratio of 1.4:1. Average fork lengths for males and females were 67.4 and 66.1 cm, respectively, with an average length of 66.9 cm for both sexes. Except for one "jack" (24.5 cm) the sample's length range was 55.5 to 79.0 cm. Scales from these fish were analyzed to determine the population's age composition, and 81 (79.4 percent) were age 2.1. The remaining fish were age 3.1 (19.6 percent) and 1.1 (1.0 percent).

Ninilchik River:

Creel census was conducted from August 5 to September 20 on the same days as Deep Creek due to the proximity of the two streams. Table 13 summarizes the harvest and catch rates for the census period. Snagging was also prevalent on this stream, although angler success was lower than on Deep Creek due to the high, tidal-cut banks and bottom debris.

Population data was collected from a sample of 29 silver salmon. Average lengths for males and females were 65.6 and 64.2 cm, respectively, with an average length of 64.9 cm for both sexes. The sample's length range was 57.5 to 71.5 cm and consisted of 15 males and 14 females for a male-to-female sex ratio of 1.1:1. Scales from these fish were analyzed for age determination, and 26 (89.7 percent) were age 2.1. The remaining three fish were age 3.1 (10.3 percent).

Stariski Creek:

Sporadic creel checks were made on four weekdays and two weekend days from August 17 to September 21. Table 14 offers the creel census results for this stream. Since Stariski Creek is the smallest of the four streams and offers the least protective cover, the fish are extremely vulnerable to angling, as reflected by the high angler success rates.

TABLE 14 - Creel Census Results, Stariski Creek, 1968.

<u>Census Period</u>	<u>Anglers Checked</u>	<u>Hours Fished</u>	<u>Total Catch</u>	<u>Fish Per Angler</u>	<u>Catch Per Hour</u>
August 17 -	26	54.5	21 SS	.81 SS	.39 SS
September 21			3 SH	.12 SH	.06 SH

The silver salmon sample contained 11 males and 10 females for a male-to-female sex ratio of 1.1:1. Average fork lengths for males and females were 69.0 and 66.0 cm, respectively, with an average length of 67.6 cm for both sexes. The sample ranged from 60.5 to 77.5 cm. Scales from these fish which were analyzed for age determination disclosed that 18 (85.7 percent) were age 2.1 and 3 (14.3 percent) age 3.1.

Steelhead Trout Studies

Anchor River:

The first observed steelhead was caught on July 28. Steelhead were

TABLE 13 - Creel Census Results, Ninilchik River, 1968.

<u>Census Period</u>	<u>Anglers Checked</u>	<u>Hours Fished</u>	<u>Total Catch</u>	<u>Fish Per Angler</u>		<u>Catch Per Hour</u>	
				<u>Weekdays</u>	<u>Weekends</u>	<u>Weekdays</u>	<u>Weekends</u>
August 15 - September 13	91	159	46 SS 5 SH 1 PS	0.46 SS -- SH 0.08 PS	0.51 SS 0.06 SH -- PS	0.23 SS -- SH 0.04 PS	0.30 SS 0.04 SH -- PS
September 21 - September 29	11	22	4 SS 12 SH 10 DV	0.36 SS* 1.09 SH 0.91 DV		0.18 SS* 0.55 SH 0.45 DV	

*Weekdays and weekends combined.

the most infrequently fish monitored during the silver salmon fishery (Table 10). The catch rate increased slightly after September 15, when most of the effort was devoted to this species and Dolly Varden. The total of 39 steelhead observed taken during the census was projected to only 102 fish harvested throughout the fishery.

Steelhead population data was obtained from the 39 fish. The sample contained 15 males, 21 females and 3 unsexed fish. The male-to-female sex ratio was 0.7:1. Average lengths were 66.5 cm for males, 69.6 cm for females and 68.3 cm for both sexes. The fish ranged from 51.5 to 91.5 cm in length.

Figure 6 shows length frequencies of the 1967 and 1968 sport-caught samples. Although the size structures of both populations are fairly similar, a noticeable decrease in the number of steelhead over 80 cm was evident in the 1968 sample.

Scales from 37 adult steelhead were analyzed to determine the age composition of the sample. Table 15 compares the population characteristics of the 1967 and 1968 samples. In general, the 1968 steelhead run was composed of younger fish with no steelhead from age groups 2.3 or 3.4 being observed. As in 1967, the most frequent age group was 3.2 comprising 62.2 percent of the sample. The occurrence of three freshwater annuli on scales of returning steelhead was 81.1 percent in 1968, as compared to 91.9 percent in 1967.

Females dominated the sample in 1968 similar to that observed at the U.S. Fish and Wildlife Service weir in 1957 and in the 1960 and 1967 samples. The female dominance ranged from 53.0 percent to 74.0 percent for those samples (Redick, 1967). In 1968, females comprised 58.3 percent of the sample.

Repeat and post-spawners in 1968 were not as prevalent as in the 1967 pre-spawning migration (Table 15). In the 1967 sample, nine fish (24.3 percent) were believed to have spawned previously as indicated by the presence of a spawning check on their scales. In 1968, six fish (16.2 percent) were interpreted to have spawned in a prior year. Two steelhead (5.4 percent) were checked in June during their post-spawning migration. A spawning check had not yet formed on their scales. In 1967, post-spawners comprised 32.4 percent of the sample. None of the steelhead observed in 1968 had more than one spawning check.

Part of the steelhead smolt outmigration is believed to have occurred from June 23 to July 7. These fish, which resembled "silvery" rainbow trout and were approximately 15.0 to 20.0 cm in length, entered the sport harvest in the lower river during the dates noted above.

Adult steelhead were taken in commercial drift nets close to beaches between the Ninilchik River and Anchor Point. The Board of Fish and Game adopted a regulation in December of 1968 to restrict drift gear from fishing closer than one mile offshore between those two points. Steelhead stocks will now be afforded additional protection during pre-spawning migrations.

TABLE 15 - Population Characteristics of Sport-Caught Steelhead, Anchor River, 1967 and 1968.

	Age Group							Total
	<u>2.1</u>	<u>2.2</u>	<u>2.3</u>	<u>3.1</u>	<u>3.2</u>	<u>3.3</u>	<u>3.4</u>	
1967:								
Number of Fish	---	1.0	2.0	6.0	12.0	9.0	7.0	37.0

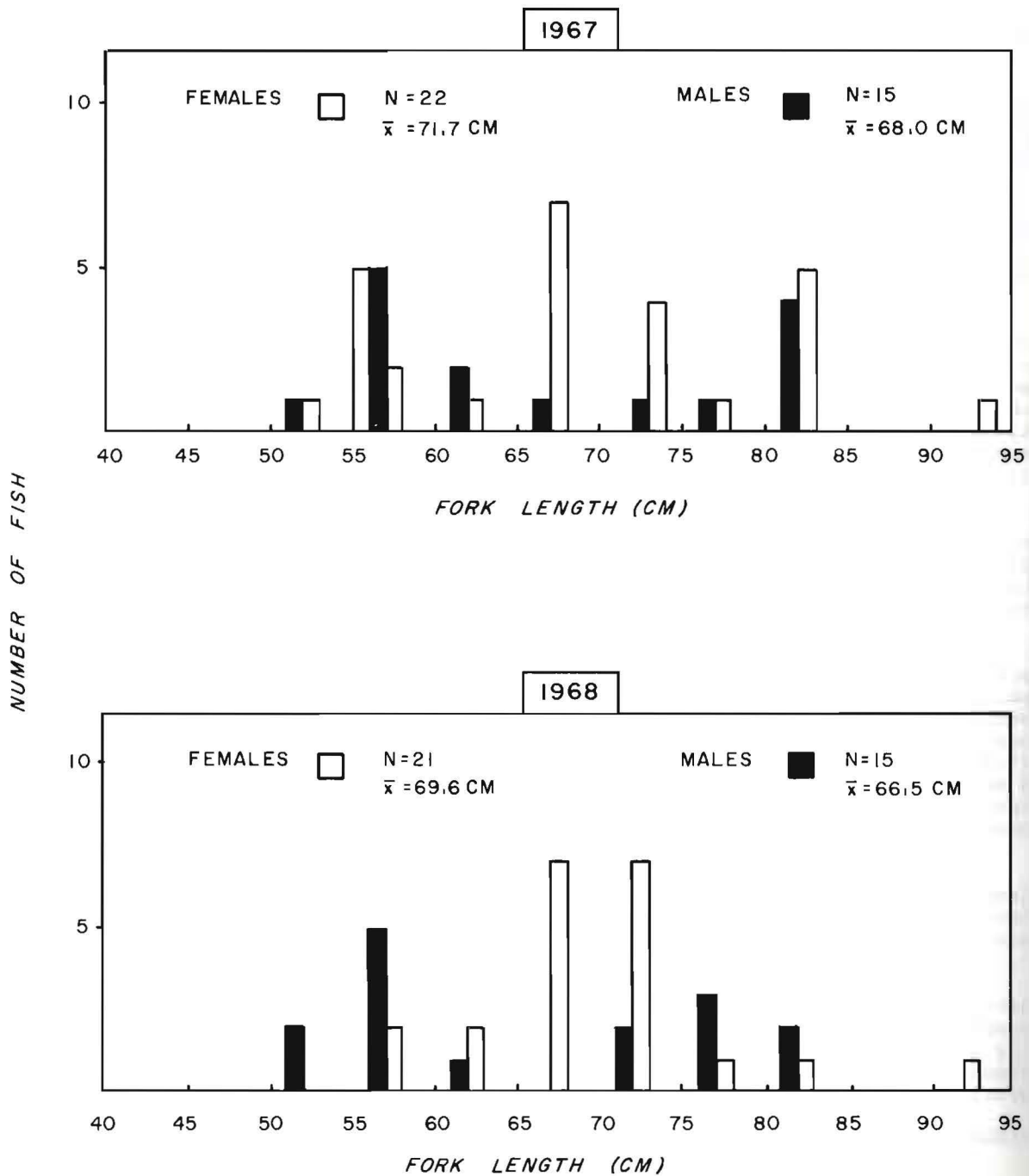


FIGURE 6. LENGTH FREQUENCY OF SPORT-CAUGHT ANCHOR RIVER STEELHEAD, 1967 AND 1968.

TABLE 15 (Cont.) - Population Characteristics of Sport-Caught Steelhead, Anchor River, 1967 and 1968.

	Age Group							Total
	<u>2.1</u>	<u>2.2</u>	<u>2.3</u>	<u>3.1</u>	<u>3.2</u>	<u>3.3</u>	<u>3.4</u>	
Percent of Total	---	2.7	5.4	16.2	32.4	24.3	18.9	100.0
Average Size (cm)	---	73.7	64.8	56.8	65.3	76.4	83.3	70.1
Number of Post Spawners*	---	0.0	2.0	0.0	3.0	5.0	2.0	12.0
Number of 2nd Spawners**	---	0.0	0.0	0.0	0.0	2.0	7.0	9.0
1968:								
Number of Fish	4.0	3.0	---	4.0	23.0	3.0	---	37.0
Percent of Total	10.8	8.1	---	10.8	62.2	8.1	---	100.0
Average Size (cm)	55.5	76.2	---	56.8	68.6	85.3	---	68.4
Number of Post Spawners*	0.0	0.0	---	0.0	2.0	0.0	---	2.0
Number of 2nd Spawners**	0.0	1.0	---	0.0	2.0	3.0	---	6.0
*Spent steelhead monitored during their post-spawning migration.								
**Steelhead returning on their second pre-spawning migration as indicated by the presence of one spawning check on their scales.								

Deep Creek:

Only three steelhead were checked on this stream from August 15 to September 21 (See Table 12). One post-spawner was observed caught during the king salmon punch-card fishery in May, and four additional steelhead were checked after September 21.

Population data was collected from the sample of eight fish. The sample contained three males and four females (one fish unsexed). The average lengths for males and females were 65.7 and 68.6 cm, respectively, with an average length of 67.3 cm for the sample. The fish ranged from 59.5 to 75.0 cm in length. Scales collected from the eight fish were analyzed for age determination; six (75.0 percent) were age 3.2 and two (25.0 percent) were age 3.1. No steelhead showed prior spawning checks on their scales.

Ninilchik River:

Of 17 steelhead sampled, 12 fish were checked from September 21 to 29 (See Table 13). Only five steelhead were observed taken during the silver salmon fishery and one post-spawner on May 26 during the king salmon punch-card fishery.

Eight steelhead of the sample were males and four were females (one fish unsexed). The average length for males was 60.4 cm and that of

females was 66.6 cm, with an average length of 62.3 cm for all fish. The steelhead ranged from 53.5 to 83.0 cm in length. Scales from these fish were analyzed for age determination, and six (46.1 percent) were age 3.1, three (23.1 percent) were age 3.2 with the four remaining fish from age groups 2.1, 2.2 and 3.3. Two steelhead (15.3 percent) had prior spawning checks on their scales.

Stariski Creek:

Three steelhead were checked in 26 angler interviews for a success rate of 0.06 fish per hour (Table 14). Scale analysis indicated that the three steelhead, all males, were age 3.1. They ranged in length from 55.2 to 59.0 cm, with a mean length of 56.8 cm. No prior spawning checks were noted.

Dolly Varden Studies

Anchor River:

A popular sport fishery exists for anadromous Dolly Varden in lower Kenai Peninsula streams. Generally, this fishery begins about July 4 on the Anchor River. In 1968, however, the fish did not become abundant until July 10. Table 10, shown previously, presents the catch rates and estimated harvests during the census periods. The total sport harvest was estimated to be 4,350 Dolly Varden.

Since angler checks were incomplete prior to August 13, it was not possible to determine an accurate measure of change in the Dolly Varden's relative abundance or size as the run progressed. Most catches were examined for length range instead of individual fork lengths. However, it was observed that the average length range of 107 Dolly Varden (28.3 to 43.1 cm) taken on July 11 and 12 shifted toward smaller lengths for 68 fish (21.9 to 29.9 cm) caught from July 28 to July 31. From August 1 through August 4, the average length range of 87 Dolly Varden (20.8 to 33.0 cm) further suggested a continued influx of smaller, immature fish. The 416 fish sampled ranged from 13.5 to 60.9 cm in fork length with an average length of 32.2 cm. This average length is considered to be biased toward the larger fish, however, since most length data was recorded when these larger fish were prevalent in the fishery (i.e., early and late in the season). The migration can best be summarized as an initial run with a preponderance of large and mature Dolly Varden, followed by a series of progressively smaller and immature fish. The early-run mature and immature fish could be taken as far as at least 10 miles upstream from late July into September, while very small (13.5 to 20.5 cm) Dolly Varden were evidently just entering the river in September.

Beginning in late September, the large and mature Dolly Varden are believed to descend the stream in a post-spawning migration to eventually return to Cook Inlet. A majority of the larger fish taken from late September until freeze-up displayed secondary sexual characteristics and were spent. It is unknown whether these fish and the small, immature Dolly Varden migrate to sea in the fall or remain in the lower river over winter to migrate during the spring.

Deep Creek:

Anadromous Dolly Varden were observed in the sport harvest during July but became very scarce in the lower river by mid-August (Table 12). The run appeared to be similar in timing to that in the Anchor River, although Dolly Varden abundance may have been less. Thirteen of the 25 fish checked ranged from 18.0 to 38.0 cm, with an average length of 26.8 cm. No information was collected after September 15 due to lack of angler effort.

Ninilchik River:

Few anglers were observed fishing Ninilchik River before August 15, and only one Dolly Varden was checked by that date. As in the other streams, angling pressure was primarily on silver salmon and steelhead stocks after August 15. No Dolly Varden were checked during this period (Table 13), and only ten fish were observed after September 13.

Other Species

Red salmon, probably bound for the Kenai and Kasilof Rivers, were taken at the mouth and in the tidal portion of Deep Creek during early July (Table 12). This was a snag fishery on high tides; the only periods when this species was available. An occasional red salmon had been observed upstream on Deep Creek in previous years during king salmon foot surveys.

Pink salmon entered the Anchor River sport harvest on July 6 and continued to be harvested into late August. The last pink salmon recorded was caught on September 1. Catch rates and the estimated sport harvest per census period are presented in Table 10. The total estimated sport catch of pink salmon is conservative because emphasis of creel census was placed on monitoring silver salmon catches in the river's tidal portion where relatively few pink salmon were taken. Most pink salmon were caught by "snagging" farther upstream where they are more abundant. The lower four miles of stream immediately upstream from the tidal area were utilized by spawning pink salmon.

Deep Creek also experienced a typical "even" year pink salmon run. A snag fishery developed at the run's peak (See Table 12). Because of their pronounced spawning coloration, most fish were released when caught.

Although some pink salmon were observed in Ninilchik River on king salmon foot surveys, only one fish was checked. Pink salmon were not as abundant in this stream as in the Anchor River or Deep Creek (See Table 13).

The staghorn sculpin, Leptocottus armatus, and starry flounder, Platichthys stellatus, were commonly taken incidentally on salmon sport gear in the tidal portions of Anchor River and Deep Creek. These fish were seldom retained for consumption. Juvenile starry flounder were observed in the tidal portion of the Anchor River during June and July.

Three dead, mature Pacific lampreys, Entosphenus tridentatus, were noted in late June and early July on the lower Anchor River. An ammocoete was observed during electro-fishing operations five miles upstream.

Additional information collected during this reporting period is on file at the Soldotna field office.

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